AGENDA ITEM #7
November 5, 2004

To: Delta Protection Commission

From: Lori Clamurro, Delta Protection Commission Staff

Subject: Summary of Delta Levees Presentations at Science Conference
(For Commission Information Only)

The Jones Tract levee break that occurred earlier this year heightened public awareness of Delta levees' importance to the Delta region as well as the State. In light of the levee break, the Bay-Delta Program's biennial Science Conference included a unique focus on Delta levees issues, including presentations relating to the link between Delta island subsidence and levee stability, new technologies being used to stabilize levees with minimal use of rock (riprap), emergency response procedures and needs, and how the break affected water exports and fisheries populations.

Commission staff had the opportunity to attend the first day of the three-day conference, which was held at the Sacramento Convention Center on October 4-6, 2004. Following is a summary of the presentations and discussions centered on Delta levees, which occurred at the first day of the conference. The abstracts associated with each of the presentations are attached to the back of the memo, in the order in which they were presented.

Morning Plenary Session

Subsidence, Sea Level, and Seismicity: Hell and High Water in the Delta *(Jeff Mount, U.C. Davis)*
Dr. Jeff Mount, a member of the Bay-Delta Authority's Independent Science Board, prefaced his presentation by noting that the Board does not necessarily endorse his position. Also, his focus was on seismicity, subsidence, and sea level rise; he did not take land use or other factors into account.

Dr. Mount explained that he used "anthropogenic accommodation space" (defined as all space available to store sediment; levees weaken as this space increases), and hydrostatic pressure (as a function of depth squared, pressure increases on levees as they are built higher and higher), as proxies for the consequence of levee failure.

His data concludes that the Delta islands have enough space to accommodate 2.5 times the amount of sediment historically washed downstream by hydraulic mining. He said

sediment can fill that space, but it would take 1,500 years to fill this space at existing sedimentation levels. The cumulative levee force at the landscape scale will yield increased force against levees, particularly in the western and central Delta.

Tendencies and Trajectories: Gradual vs. Abrupt Landscape Change

Gradual landscape change

- Potential for island flooding increasing over time
- There is a backlog of $1 billion to achieve PL 84-99 standards for Delta levees
- Jones Tract was a $50-100 million failure (this has implications for expenditures on maintenance of Delta levees)

Abrupt landscape change:

- Potential for significant island flooding during major floods and seismic events
- Problems with levee emergency response (only one contractor in the Delta, which is currently being sued over constituents found in the materials used to repair the Jones Tract breach).

He noted a two in three (2/3) probability that abrupt landscape change will occur in the Delta over the next 50 years.

Conclusions:

- Gradual landscape change is a certainty; abrupt change is highly likely.
- The Delta will experience an increasing number of levee failures
- There is no feasible or economical method to restore elevations on Delta islands (he later said that while restoring elevations on subsided islands is feasible, it is not economically viable)
- CALFED planning remains predicated on a fixed, rather than a dynamic, landscape.

Afternoon Session: Lessons from the Jones Tract Levee Breach

Delta Levee Emergency Response Planning in Light of Jones Tract Flood *(Tom Zuckerman, Central Delta Water Agency)*

Jones Tract is the third catastrophe during low-flow conditions that has occurred in the Delta over the last 30 years; usually levee breaks occur during big storms, high winds, and high tides. There is a need for a robust, ongoing levee maintenance program.

Problems with the existing program include:

- Short work windows – there is a desire to have short work windows extended based on whether fish and/or contaminants are present, rather than restricted to arbitrary dates. The Department of Fish and Game and others are studying this possibility; levee interests should piggyback on this work.
- With respect to specialized equipment, there is a steadily declining population of equipment not only for regular levee maintenance, but emergency situations as well.
- Reclamation Districts pay 25-50% of costs, and financial needs of the Levee program are significantly small compared to the expenditures of other CALFED programs. He

said Delta levees can be adequately maintained on a budget of $6 million per year, but more money could be used to build up stocks of specialized equipment and talent.

He noted that to his knowledge, no levees have failed due to earthquake seismicity (a risk assessment study to analyze threats to Delta levees was funded by CALFED, but has not been completed due to contracting issues). The biggest seismic threat is in the West Delta area; 40% of the Delta's seismic threat is on one island – Sherman Island.

Lessons Learned from the Jones Tract Levee Break *(William Burkhard, DWR)*

1. The press should be imbedded in the emergency response process as much as possible; use the press as allies.
2. Standardized emergency management systems (SEMS) work. Get the work done first and worry about accountability later. Always push decisions down to the most experienced level.
3. The Delta needs more floodfight planning.
4. Normal State operations are inadequate during floodfight; DWR is changing processes to enhance response.
5. DWR needs money to fight floods.
6. DWR needs to form a command post, with the necessary authority given to DWR to start repairs immediately.

DWR is preparing for the next emergency:

- Issues with pumping and repair to be addressed
- Working with Reclamation Districts and counties to address a regional perspective, and allow crossing of county lines.
- Working on a GIS-based floodfight plan, and sharing it with Delta counties.
- Considering creation of three SEMS teams; the Delta SEMS would remain in place, and a Sacramento and a San Joaquin River team would be added.
- Increasing the amount of floodfighting supplies on hand and having them nearby.

Effects of the Jones Tract Levee Failure on Central Valley Project and State Water Project Operations *(John Leahigh, DWR)*

140,000 acre-feet of water entered Jones Tract over a two-day period. Mr. Leahigh looked at the effects of this break on salinity at Emmaton and at Jersey Point in the western Delta.

At Jersey Point (San Joaquin River), he noticed a dramatic increase in daily EC (electrical conductivity, a measure of salinity) just after the breach; at that time, pumping from the Delta was stopped and replaced by upstream sources.

At Emmaton (Sacramento River), there was a much more dramatic increase in salinity due to the "big gulp" effect of the breach. Supplies for the federal Central Valley Project were augmented by storage from San Luis Reservoir, south of the Delta, utilizing reduced and deferred exports.

The federal Central Valley Project had an export impact or loss of 30,000 acre-feet of water, and received temporary urgency approval for a Joint Point of Diversion with the State Water Project.

The State Water Project had an export impact or loss of 10,000 acre-feet; deliveries and pumping were deferred to later in the season.

The increase in water supply in the channels from pumping out Jones Tract will likely negate the 30,000 acre-foot and 10,000 acre-foot impacts to the projects. In conclusion, there was no major impact to the Central Valley Project or State Water Project.

Numerical Modeling of Hydrodynamic and Salinity Impacts of the Upper Jones Tract Levee Breach *(John DeGeorge, Resource Management Associates, Inc.)*
Research Management Associates developed its own Bay-Delta model as a decision-making and emergency response tool; it is conducting follow-up modeling to see how accurate its model was.

Three scenarios were modeled: Breach with repair; Breach without repair; and No breach.

The model suggests that repairing the breach did not reveal different results than not repairing it (at Emmaton, Sacramento River), but received slightly different results for Jersey Point (San Joaquin River), where they found that salinity decreased slightly when the levee breach was not repaired versus when it was repaired.

The outcome of the model suggests that salinity increases west and south of Franks Tract were small but manageable, and it appears that salinity decreases if the breach is not repaired.

Want to streamline emergency response modeling:
<u>Geometry</u>
- Need accurate Delta topography
- Development of model geometry

<u>Initial conditions</u>
- CDEC website database is essential
- Improve process to establish initial salinity distribution

<u>Forecast conditions</u>
- Predicted tides available
- DWR Delta Hydrologic Conditions Forecast
- Develop emergency response scenarios

Fishery Effects of the 2004 Jones Tract Levee Failure *(Pat Coulston, DFG)*
Conclusions:
- The timing of the breach was such that there was low exposure of juvenile salmon.
- Small proportions of the cohort (entire populations) for both Delta smelt (~100,000) and striped bass (~1.5 million) were lost directly to the flooding.

Levees, Vegetation, and Habitat in the Sacramento-San Joaquin Delta – Can They Coexist? *(Jeffrey A. Hart, Hart Restoration, Inc.)*
There are several causes of levee failure:

- Erosion from wind, waves, and boats
- Poor soil used to build the levees (result of sandy, incohesive hydraulic mining debris)
- Overgrazing by sheep or goats is detrimental; small herds should be kept moving quickly along the levee
- Land-side boils (weak spots in the levee that allow water to seep through it)

Plants can cause erosion:

- Single isolated trees
- Large shade trees can limit growth of understory plants, and can also cause water to swell around them in flood events; this leads to erosion.

Examples of levee restoration projects:

- Tidal mudflat restoration at the North Fork of the Mokelumne – riprap, soil, and plants, including boxes with plantings.
- American River/other revetment studies.
- Roughness (good) disposition study: slow the flows with roughness so that sediment drops out and erosion slows.

Needs for a safe levee system:

- Stable landform with gradual slopes
- Tules and wetland plants on tidal mudflat
- Base of levee bank (perennial, herbaceous, small to medium-size trees)
- Vegetation management on the land side (selective spraying; avoidance of overgrazing)

Geomorphic and Geologic Mapping for Restoration Planning, Sacramento-San Joaquin Delta Region *(Christopher Hitchcock, William Lettis & Associates, Inc.)*
The objective of the ongoing mapping study is to see if there is a correlation between levee foundation composition and levee breaks. Ongoing mapping includes:

- Distribution of geomorphic land forms
- Floodplain and habitat restoration base conditions
- Distribution of mercury and other contaminants associated with mining debris
- Levee foundation materials (peat vs. natural levees, clay, etc.)

Levees built on top of historic mining debris and channel deposits are generally weaker and less porous (more sandy), and yielding more boils, than those built based on historic channel configurations.

Deformation of Delta Levees *(R. Kevin Tillis, Hultgren-Tillis Engineers)*
Mr. Tillis studied deformation of Delta levees built on peat and marsh deposits; there was no focus on seismicity.

Monitoring of lateral deformation on Bouldin Island – the levee built to evaluate the strenth of peat.

Building on peat soils yields deformation.

Levee Integrity and Subsidence: Tied at the Hip for the Future of the Delta
(Christopher S. Enright, DWR)

- Delta levees are at high risk for major failure.
- Recovery, if attempted, will be long and costly.
- The Delta ecosystem will change.
- Subsidence is the driver.

There is a one in four (1/4) chance of multiple levee failures due to seismicity.

Not all levees are essential to integrity of the State and federal water projects.

Session Summary: Long-Term Planning and Research Needs for Delta Levees *(Jeff Mount, U.C. Davis)*
Research Needs:

- Risk assessment, not only for levees, but for the Ecosystem Restoration Program, Water Quality Program, and other CALFED components.
- Subsidence can be reversed, although it's probably not economically feasible.
- Scientists don't know the extent of subsidence.

Gil Cosio, MBK Engineers, pointed out that the biggest problem has not been peat soils, nor subsidence, but freeboard. One research need is a three-dimensional view of Delta levees to determine where voids may exist.

John Cain, Natural Heritage Institute, suggested focusing site-specific subsidence reversal studies on Sherman and Jersey Islands. There is an abundance of rice straw to "fill" the interior of the islands, which can help reverse subsidence on these islands.